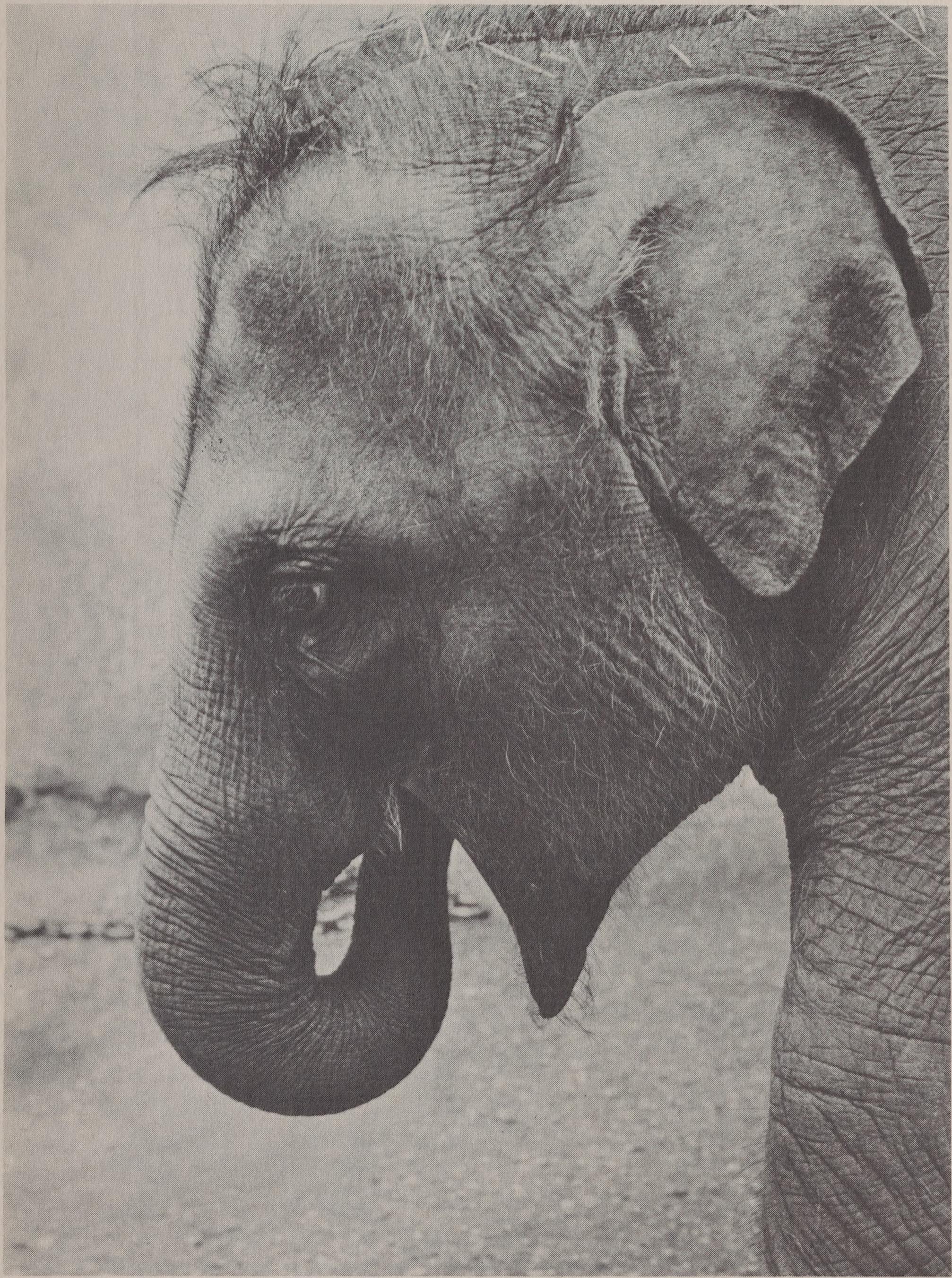


# THE ZOO GOER

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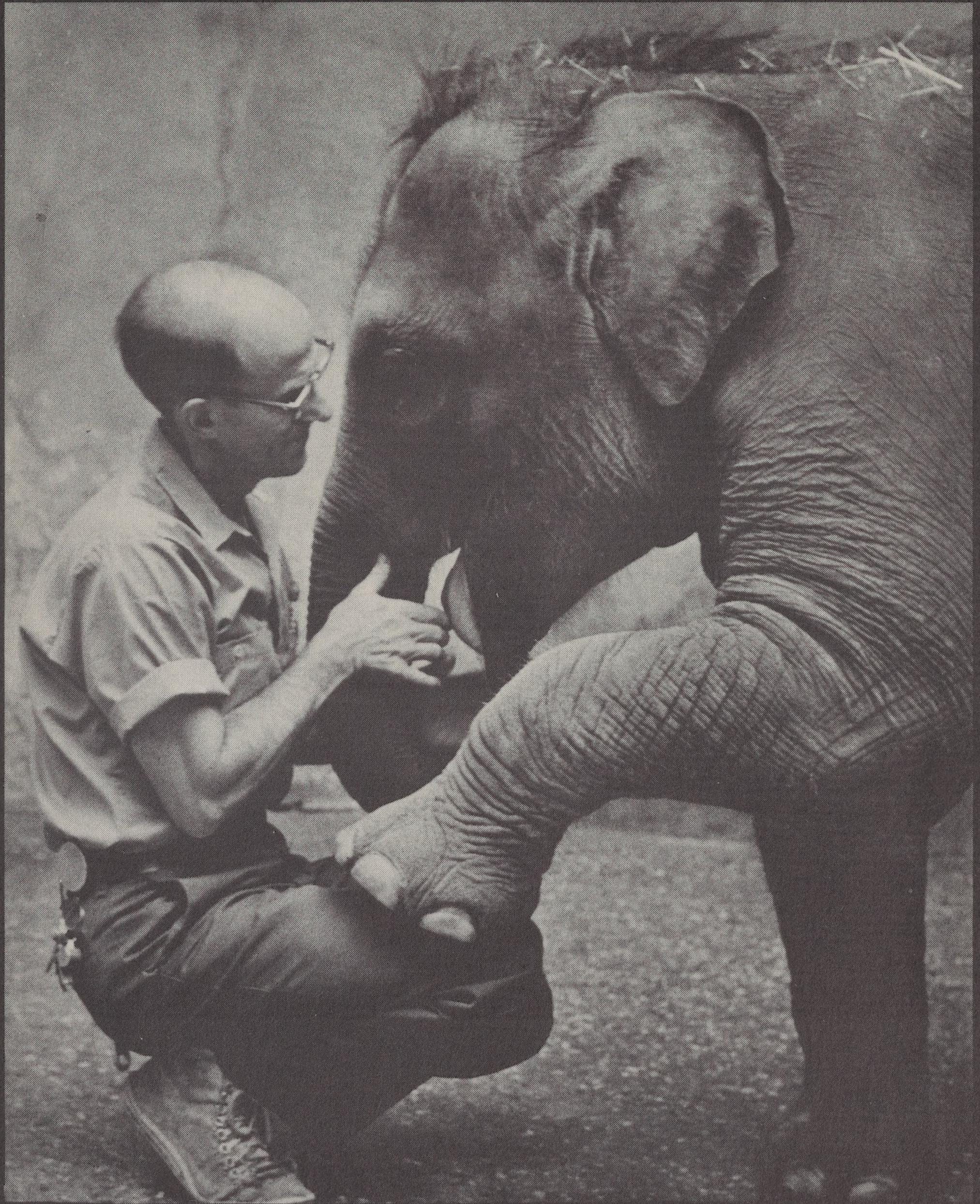
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# A Baby Elephant Guest

On the afternoon of October 11th an attractive winter guest arrived at the National Zoo's Elephant House (*number 11 on map*)—a two-year-old female Asian elephant named Ollie, who makes her permanent home in the Salisbury, Maryland, Zoo. Driven up to the door of the building in the trailer that had brought her from Salisbury, Ollie was walked through the building to a cage to the left of that occupied by the Zoo's two adult female Asian elephants. There were two reasons for her visit. First, adequate winter quarters for her are lacking at Salisbury. Second, and, more important, it was hoped that Ollie could eventually be introduced to the Zoo's adult females, Shanti and Ambika. Ollie has been raised in captivity by human caretakers without opportunity for contact with her own species; and Shanti and Ambika will hopefully provide her with the early companionship of other elephants that she will need if she is to grow to be a normal adult elephant.

Ollie arrived in Salisbury on June 9, 1972. She was then 36 inches tall and weighed 325 pounds. Even at this substantial size she was only about eight months old. She was believed to have been born on October 14th of the previous year on a breeding farm in Thailand; and at birth she must have already weighed the approximately 200 pounds usual for newborn Asian elephants. Now, at two years of age, she is four feet tall and weighs some 600 pounds. But she still has some of the appearance of an infant; for instance, the fringe of comparatively thick and noticeably longer hair along the back and the long hair on the head—present in baby elephants but disappearing as they grow older—are still clearly visible in Ollie.

Ollie has always been an extremely healthy young elephant, but there was one element lacking in her early upbringing. She had become "imprinted" on her human foster parents; in other words, she had come to respond toward them in many of the ways in which, brought up in the wild in a herd of elephants, she would respond toward other elephants. In particular she had come to rely on a small number of familiar humans for reassurance and protection when she was frightened or upset.

The phenomenon of imprinting occurs in

the young of a wide variety of vertebrate species. It was originally discovered and has been most intensively studied in newly hatched birds, particularly waterfowl. Thus artificially incubated ducklings were found instinctively to form an attachment to the first relatively large moving object they saw after hatching. This was usually a human keeper, and they would follow him as they would normally follow their mothers. Later, when fully adult they might even display sexually to humans rather than to members of their own species.

Evidently ducklings have an innate tendency to form such a strong, early attachment to an object with only quite generalized characteristics—the most important being that it moves and that it is of large size relative to themselves. In the natural situation the mother is the only available object having these characteristics; and, because it provides the ducklings with a strong incentive to follow their mother in search of food soon after hatching, imprinting thus is of considerable survival value. Imprinting also seems to give hatchlings an "image of their own species" that they tend to retain throughout life. Though there is evidence for an innate "image of their own species" in young vertebrates in that imprinting on an adult of their own species appears to be stronger than imprinting on a foster parent, it is clear that this form of attachment can and does lead imprinted animals in adult life to "act as if" members of the foster parent species were members of their own species and thus the proper objects of innate behavior patterns that would ordinarily be directed towards members of their own species.

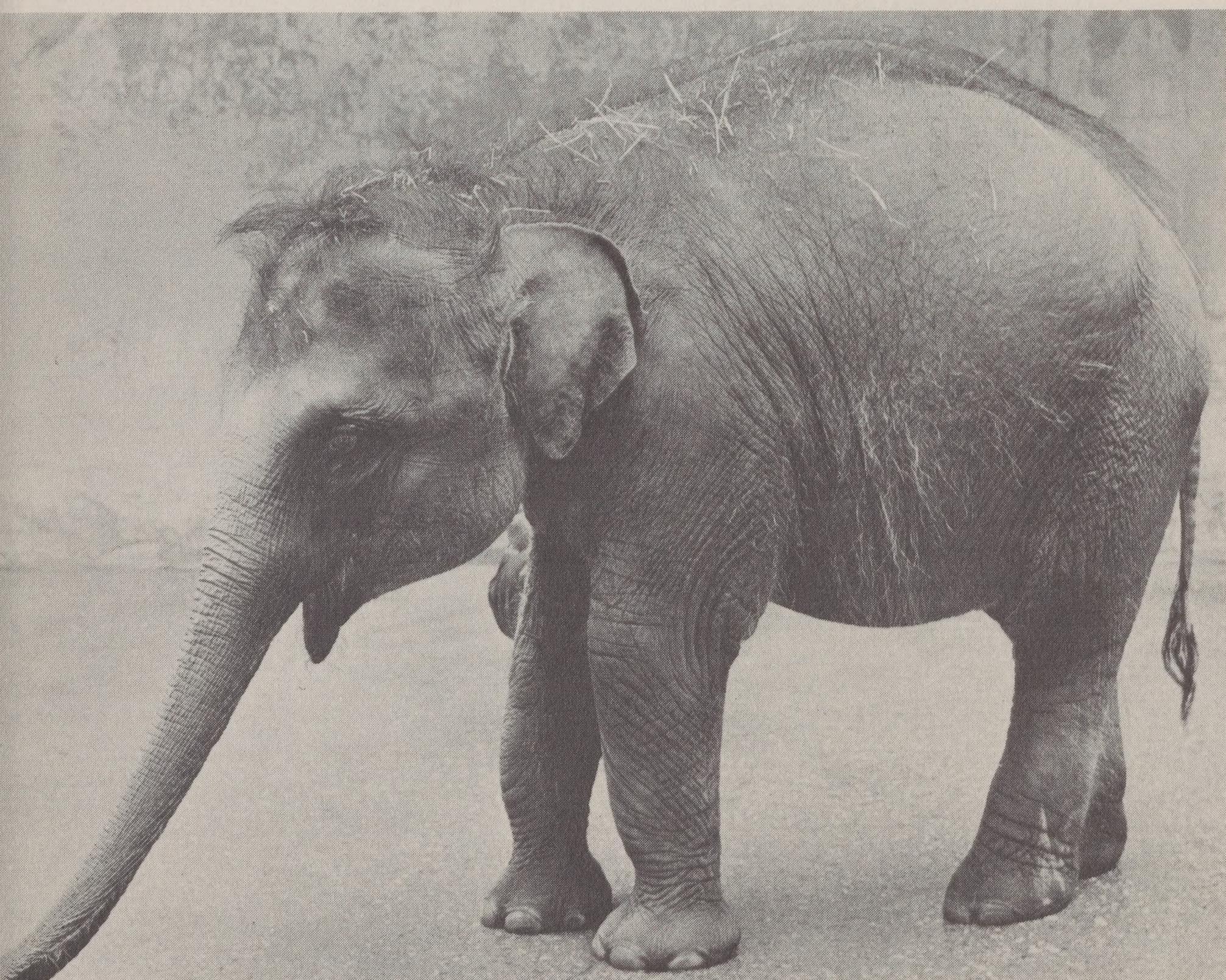
All of which it is hoped can be prevented in Ollie's case—as it must be if she is ever to be able to live compatibly with other elephants or perhaps eventually breed. For an adult elephant imprinted to humans and suddenly introduced to other elephants would very likely consider them alien and dangerous creatures and respond with either terror—or aggression. And even if the newcomer were not itself either hostile or afraid and even if the other elephants were at first disposed to accept it as a member of the elephant group, they might eventually turn on it when they found it had no appreciation of the nuances of

elephant society. Social groups of mammals have a great variety of signals and responses designed to prevent conflicts among their members; but a member of a social mammal species that has not had the opportunity to be with others of its kind early in life will not have learned these prerequisites to peaceful interaction and runs the risk of unwittingly transgressing against the social order.

Originally it was asserted that it is one of the hallmarks of imprinting that, unlike other forms of learning, it has effects that are irreversible. Later, however, this was shown to be an oversimplification. In mammals particularly imprinting has found to be neither in many cases so instantaneous a phenomenon as it is in birds nor necessarily so permanent in its structuring of the individual's behavior. In mammals—with their less instinctive behavior, more plastic and involving a more gradual accumulation and a wider repertoire of learned responses—imprinting has been found to be reversible in many cases by a

slow process of habituation, particularly if the process is begun early enough in life. It is just such a gradual process that Ollie is expected to undergo this winter.

The reversing process began the very day of her arrival at the Zoo. She had only been in her new enclosure a few minutes when the door connecting it with Shanti and Ambika's indoor cage was opened about a foot to allow her to become acquainted with them by sight and scent and to allow them to do the same with her. Earlier, when asked for an example of the strength of Ollie's imprinting on him and her other human caretakers, Stefan Graham, Director of the Salisbury Zoo, had replied: "When she first sees another elephant, she'll probably be frightened—and when she's frightened, she runs to me for protection." Actually, however, it was the other elephants that showed the greater amount of distress. Steve was with Ollie, holding on to her to provide reassurance and to prevent her from running in panic in the event that she felt inclined to do so. But



Shanti and Ambika, their trunks waving to pick up the strange scent, backed uneasily to the right wall of their cage, as far as they could get from the small but totally unfamiliar presence. In obvious fright, they defecated and urinated profusely.

Finally Al Perry, Shanti and Ambika's long-time keeper and trainer, entered their enclosure and attempted to urge them to approach Ollie somewhat more closely. He climbed to Ambika's shoulders, mahout-style, and ordered and prodded her forward. As he prodded her behind each ear in turn, Ambika would take a hesitant forward step; but when with great difficulty he had succeeded in moving her about three-quarters of the way across the cage in the direction of the partially opened door, Ambika—despite his protestations—decisively back-tracked all the way to the other wall. It was thereupon decided to abandon any further attempts at introduction for that day.

The next day a different strategy in the habituation effort was tried. While the older elephants were in their outdoor yard, Ollie was led into their indoor enclosure. Thus it was hoped that she would be able to familiarize herself with their scents and with the territory in which she would eventually meet them and which she would eventually share with them. Meanwhile she would be learning, perforce, to abandon her attachment to specific human foster parents. Her attachment was strongest to Steve Graham, and on her first day at the National Zoo Ollie had to be physically restrained in order for Steve to be able to leave her enclosure.

In captivity, of course, it is an absolute necessity for elephants to recognize and accept certain human keepers—and to submit to their commands. This is necessary so that keepers will be able to enter their cages safely for routine cleaning and so that they will be able to move the elephants between indoor and outdoor enclosures at the proper times. It also makes for elephants that are docile, that do not object to the fact of their confinement or respond with hostility to the public viewing them. However, based as it is on the form of elephant-training long practiced in India and other Asian countries, this form of elephant-man

relationship is different from one of imprinting. While responding to the man as master, the elephant essentially retains its normal responses to other elephants. The man takes the place of the dominant member of an elephant group.

As Ollie grows up she will have to learn to respond to keepers in this fashion, and learning to be confident in the presence of her new National Zoo keepers will doubtless help her. Al Perry is already a familiar figure, having visited her in Salisbury before her move to Washington. Because of her youth his relationship with her is not yet fully that of an elephant-trainer; but it will increasingly become one, and learning to trust and follow the directions of other human beings than those on whom she was imprinted will doubtless be a further factor in helping her break her early attachment and be a more normal and mature elephant when she returns to Salisbury in April.



# ZOO NEWS

## Mammals

### Greater Kudu Calves

Each of the Zoo's three adult female greater kudus (*Tragelaphus strepsiceros*), located together in the same enclosure (number 9f on map), gave birth to a single calf within a period of four days between



One of the Zoo's greater kudu calves with its mother (number 9f on map).

September 18th and September 21st. Last year the same three females had also given birth within one week of each other. Of the three latest calves one was a male, and two were females; together they raised to a total of 16 the number of calves of this species born here since 1968 and to eight the current population of the Zoo's herd.

The greater kudu has a wide, though discontinuous, distribution in East and South Africa; characteristically it is found in rocky hill country with scattered or dense brush or on brush-covered plains. Its diet consists mainly of foliage, on which it browses at night and in the early morning and evening; during the middle of the day it usually rests, concealed in the brush. Greater kudus form small groups, usually numbering between six and twenty, though groups containing as many as 30 or 40 individuals may occasionally be encountered.

The groups are two types: those consisting of a number of females and their young and those consisting solely of males. The all-male or "bachelor" groups may contain males ranging in age from yearlings to fully mature bulls; in addition, some adult bulls are solitary. Each greater kudu group seems to remain rather consistently in one home range, although it is not known whether the groups are territorial in the sense that they defend their home areas against other groups. In time of severe drought, however, a group may travel far from its usual haunts in search of water.

Males join up with female groups only for mating. This may apparently take place at any time of the year in some parts of the species' range, but definite peaks have been reported for other areas. In any event during the short time a male is with a female group he may mate with several of its members. The readiness of the greater kudu male to mate with a number of females during a short period of time is well illustrated by the Zoo's adult male. Although he is kept with the females year round, for the past three years he has regularly impregnated all of them within such a short time that the longest interval during which births have taken place here each year since 1971 has been two weeks.

Unlike those of many antelope species, female greater kudus lack horns; the spectacular spiral horns for which this

species is famous appear only in the male. Males use the horns for a variety of purposes. Two bulls in breeding condition may employ them in stately ritual combat over a herd of females. The bulls may lock horns head on and test each other's strength by pressing against each other; at other times it is believed that the bulls may approach each other from the side, and one may lock its left horn with the other's right horn. In courtship of the female, a male steps in her path and tilts his head back and away from her to display his horns to her. Finally males use the horns to mark their environment by stripping the leaves off the branches of shrubs and trees and by plowing up the earth; such behavior probably advertises the presence of a male in breeding condition to other males and warns them away. Occasionally a male may injure one of his horns by over-vigorous marking of this sort, as the Zoo's male did about a year ago.

The Zoo's newborn male will not have visible horns until he is eight or nine months old. However, even at birth the bones that were eventually to grow into horns were present as small "buttons" beneath the skin of his forehead. At first these bones were not connected with the skull, but soon after birth they became fused with it and began their very gradual development. When they begin to grow through the skin the skin will produce from its own living cells a non-living horny sheath to cover them; this horny material will be added to at the base of the horns as they continue to grow throughout the animal's life. When the Zoo's young male is sexually mature at the age of a year and a half, his horns will be only six or eight inches long; but in his fifteen or more years of life they may reach 40 inches or more in length.

## A Mate for Atjeh

The young male orangutan (*Pongo pygmaeus*) that is known as Atjeh was the first-born young of the Zoo's breeding pair, Archie and Jennie. He was born in April, 1966, and is now old enough to have a mate of his own. A suitable female, born in captivity in October, 1967, has been acquired and placed with him in his cage

at the rear of the Small Mammal Building (*number 15 on map*). Atjeh and the female—nicknamed “Pensi”—proved instantly compatible when first introduced on September 14th. Five days later they were seen copulating four or five times.

Another change in the Small Mammal House is that the gorilla alcove is closed to the public. The Zoo's female gorilla (“Femelle”) is pregnant at this writing and is expected to give birth in mid-November.

### Panda House Improvements

New and more spacious outdoor yards have been completed for the giant pandas (*number 10 on map*); larger indoor cages are also being prepared, and the male's is already completed. The outdoor yards, planted with bamboo, are three or four times the size of the previous outdoor yards, and the indoor cages will be doubled in size. The pandas will be able to see each other when both are outside through a wire-mesh-covered moongate in the wall separating the two enclosures. The moongate will be opened to allow the pandas access to each other when they are ready to breed.

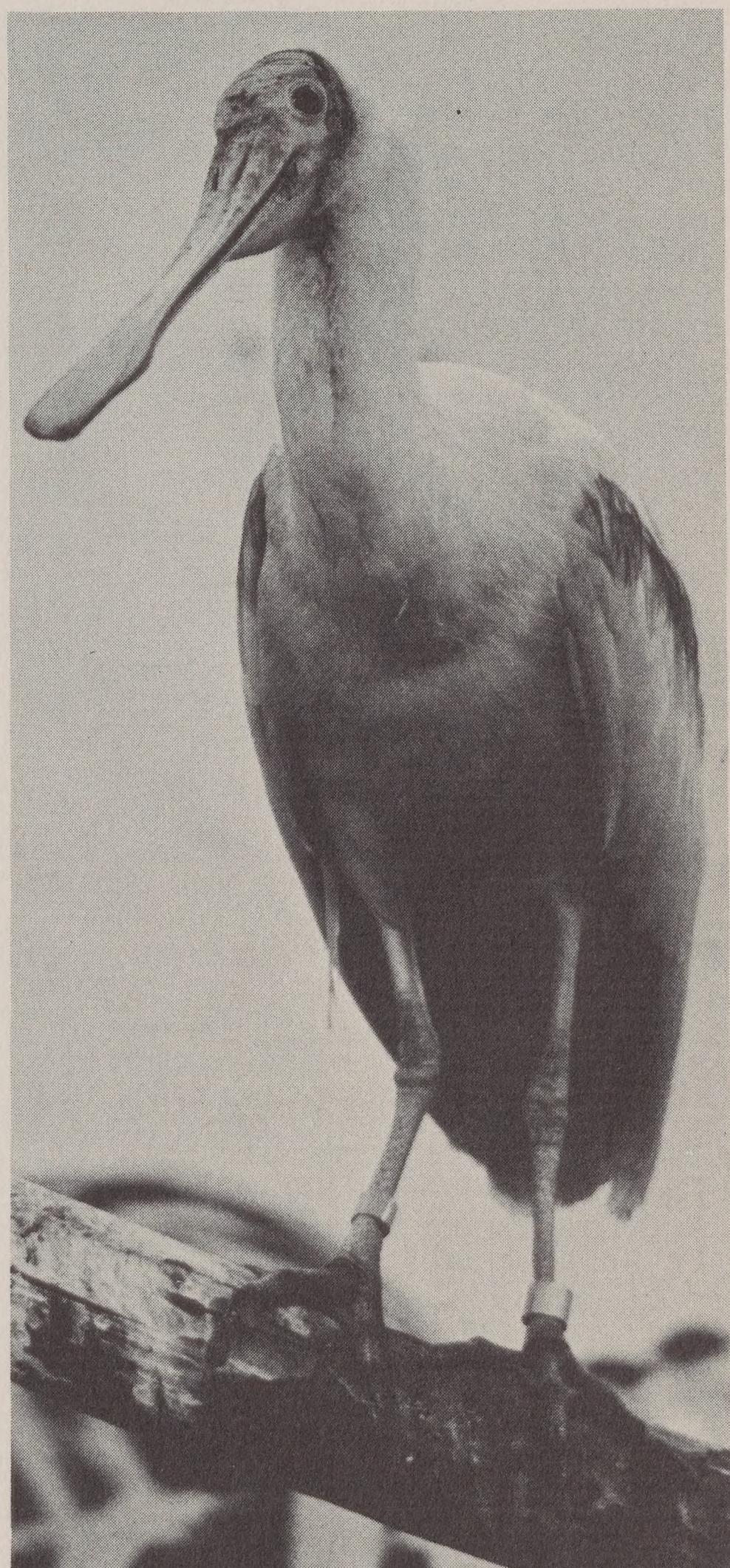
It is not at present known when this will be. Last spring the female, Ling-Ling, surprised Zoo officials by apparently coming into estrus. The female giant panda is known to come into estrus for about a week in the spring and again in the fall if she has not mated successfully in the spring; but it was believed that she does not have her first estrus until she is three years old, and Ling-Ling was only two-and-a-half last spring. On the other hand it was the third spring of her life, since she was born in the fall of 1970. The pair were put together; but the male, then only two years old, showed by his behavior toward the female that he was not yet sexually mature.

Hsing-Hsing is growing fast, however, and he has by now outstripped the female in weight. At their last weighing on August 27th he was recorded at 241 pounds, and the female at 236 pounds. So by next spring or the subsequent fall or spring it is possible that the pair will be able to mate successfully in their new outdoor yards.

# Birds

### Roseate Spoonbills

A pair of roseate spoonbills (*Ajaia ajaja*) have been acquired and placed in the scarlet ibis cage at the rear of the Bird House (*number 5 on map*). This species is one of the most spectacular of our native avifauna, aptly described by Robert Porter Allen, who made a pioneer study of its distribution and habits in the United



One of the Zoo's new roseate spoonbills.

States, as a bird that "exhibits paradoxical glamor and drollery." Its bright plumage excites human admiration, but the unusual shape of its bill often strikes us as comic.

The six species of spoonbill belong to the family Threskiornithidae, the same family as the ibises, from which they differ little except in the shape of the bill. They are found throughout the tropics of the world and in some temperate areas; but the roseate spoonbill is the only one that inhabits the Western Hemisphere. It breeds in scattered locations throughout Central and much of South America; in Mexico, Texas, Louisiana, and Florida; and on some of the Caribbean islands. It was almost exterminated in the United States toward the end of the last century and in the early decades of this century but, since being accorded protection, has recovered somewhat. Although it has been asserted that the spoonbill was not hunted as extensively for the millinery trade as many other American birds of brilliant plumage, its feathers were often sold commercially, especially for use in fans; and, since it often nested in association with other plume-birds, commercial hunting of them must have frequently disturbed its nesting sites. As the formerly wild regions in which it lived and bred became increasingly inhabited, it was hunted for "sport" as well and sometimes even for food.

Apart from man's activities, the roseate spoonbill's distribution is of necessity limited by its habitat requirements. It needs shallow water, either salt or fresh, in which to search for the small animal life that makes up the bulk of its diet. Small fish are its most important prey, followed by crustaceans, aquatic insects, and mollusks; occasionally, too, it eats some marsh grass and water weeds. In feeding the spoonbill does not use its bill to scoop prey out of the water, as the comparison with a spoon might suggest; rather it forages by swinging the partially opened bill from side to side underneath the water. The bill is equipped with sensitive nerve endings, particularly in the tooth-like processes known as "nails" at the end of each mandible; and touch is evidently the most important sense in locating prey. The widened ends of the bill serve to capture and hold prey when it is located; they are doubtless able to hold on to larger prey than a thin bill would—given the manner of feeding, in which the prey is more or less happened upon rather than individually pursued. The spoonbill's foraging pattern is innate—almost a pre-

requisite to feeding, even when it is not necessary; and the Zoo's birds move their bills from side to side while feeding at their pans.

Like their relatives the ibises, the spoonbills are colonial nesters. Roseate spoonbills that breed in the United States arrive from the south in flocks in late February or early March, and form pairs in April. At that time females move apart from the flock, and each chooses a prominent perch in a tree or shrub where she spends much of her time. At such a perch the female may frequently take hold of and shake a nearby branch with her bill, especially when a male approaches her. The female's station is often later used as a nest site, and the female's possession of it and her behavior there attract a male to approach, bobbing his head up and down as he lands next to her. The female at first is hostile to the male, but eventually she accepts him. Courtship involves bill-fencing and bill-rubbing, and one bird may approach the other with a stick in its bill.

The female does most of the nest building, while the male supplies her with twigs. The eggs hatch after an incubation period of 23 or 24 days. At hatching the young have bright pink skin, bills, and feet, with a sparse covering of white down that gradually increases in length and density until replaced by the first feathers at the age of about a month. The first or juvenal plumage is mainly white, and over the first 33 to 36 months of life is replaced at successive molts by different stages of plumage that gradually approach the more brilliant hues of the adult.

### White-Faced Glossy Ibis

Visitors familiar with the groups of the graceful scarlet ibis and sacred ibis at the Bird House will be interested to know that members of another ibis species have been acquired. These are seven white-faced glossy ibis, or white-faced ibis (*Plegadis chihi*), in the sacred ibis cage at the Bird House (number 5 on map). This species is native to the Americas; in the United States it breeds in substantial numbers from Louisiana west to California and north to Oregon, Nevada, and Utah. It is also found in Mexico and in South America; evidently better adapted for life in subtropical and warm temperate regions than in the tropics themselves, it is absent from Central America south of Mexico and



Two of the Zoo's new juvenile white-faced glossy ibis.

from the northern third of South America, reappearing in southern Brazil, Argentina, and Chile. A close relative, the glossy ibis (*Plegadis falcinellus*), is found in the eastern United States and in the Old World.

The Zoo's birds are juveniles hatched this past spring and lack the decidedly bronze coloration of the head, neck, back, and underside that will appear when they are fully adult. Now they are a deep, iridescent green over most of the body, except for the grayish head, neck, and underside. In the adult plumage the green color will remain on the wings. The white face from which this species derives its common name is also lacking; it consists of a fringe of white feathers around the bill which appears only in adults in the breeding season.

In this country white-faced glossy ibis breed between April and July, laying their eggs somewhat later in the more northern parts of their U.S. range than in the southern parts. They nest in marshes and wet bottomlands, often in large colonies, which they may share with herons, egrets, or other wading birds. The nest is built of twigs and reeds and lined with soft marsh grass. The birds may bend down the tops of a number of reeds and place the nest across them, or they may build it on a large pile of floating dead reeds and other vegetation.

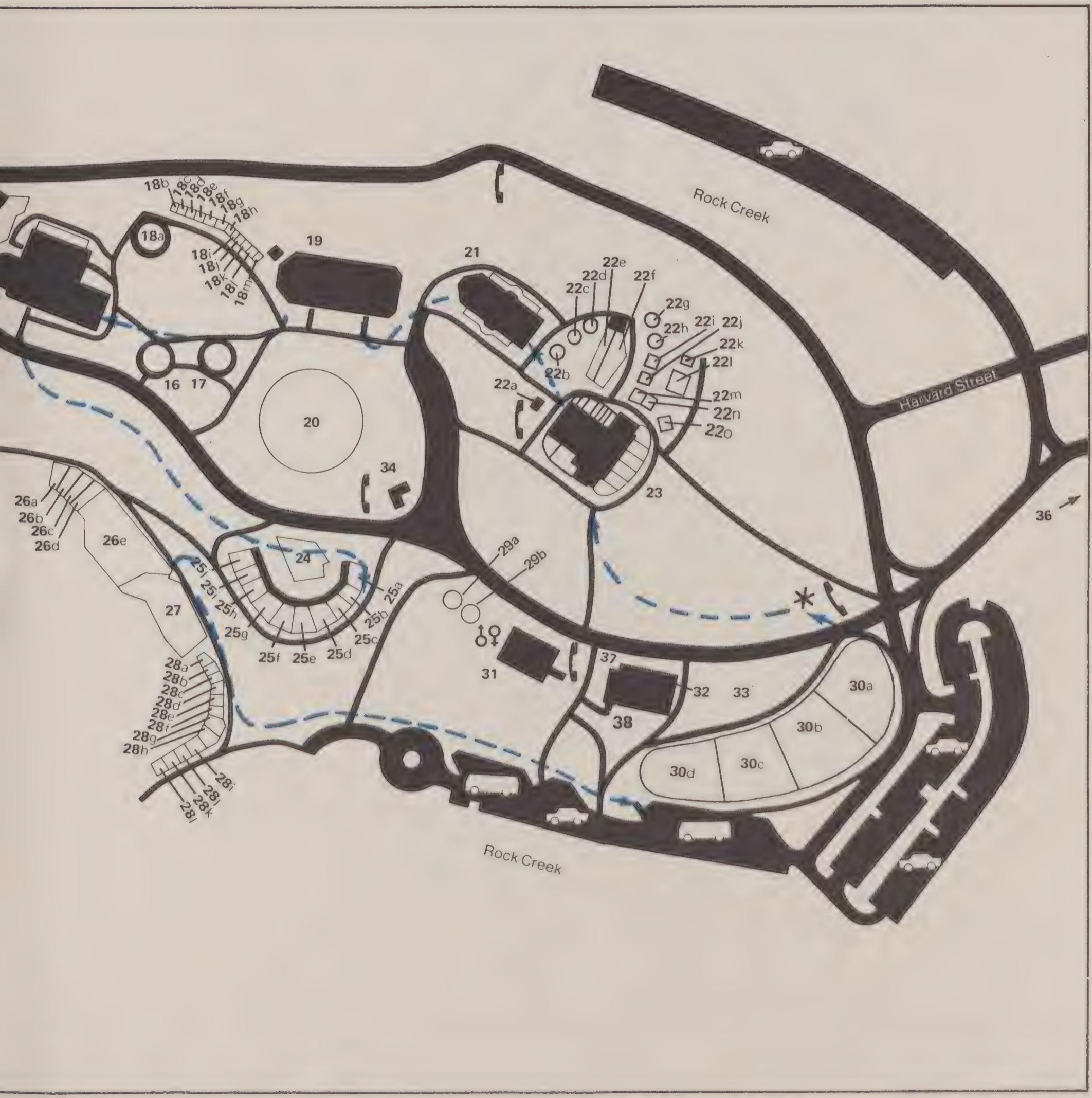
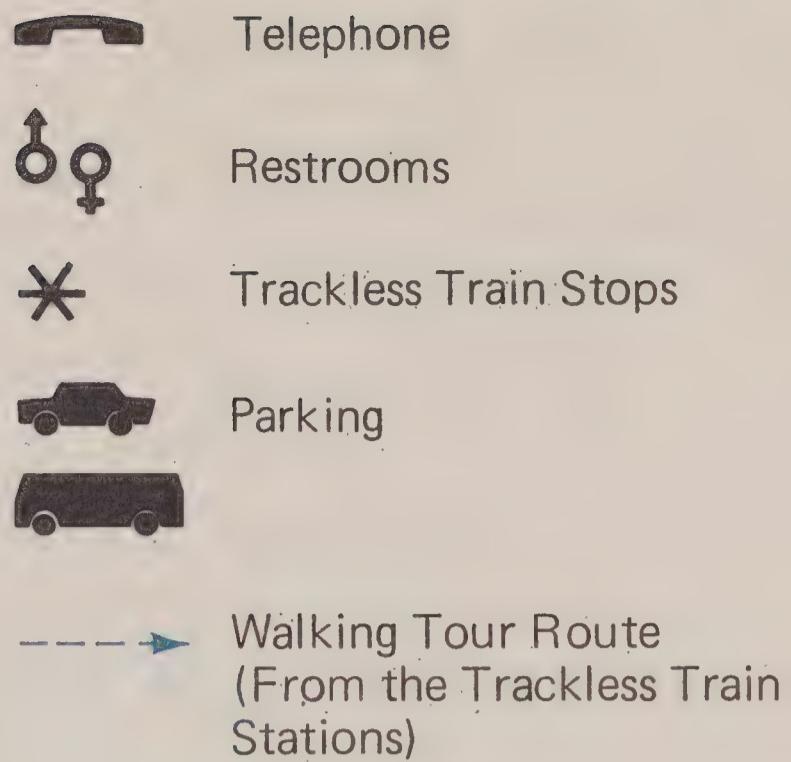
The white-faced ibis, like the other ibises, frequently uses its long down-curved bill to probe in sand in search of small mollusks, crustaceans, and worms. It also captures small fish and frog tadpoles in shallow water at the edges of pools or rivers and eats some insects.

# ZOO MAP

1. Connecticut Avenue pedestrian entrance
2. Connecticut Avenue vehicular entrance
3. Deer and antelope areas (a-j)
4. Great Flight Cage
5. Bird House
6. Pheasant and crane line (a-u)
7. Raptor cages (a-d)
8. Delicate-hoofed stock building (a-c)
9. Hardy-hoofed stock complex (a-i)
10. Panda House (a-c)
11. Elephant House
12. Water birds (a-e)
13. Hawks and owls (a-c)
14. Black Rhinoceros Yard
15. Small Mammal Building
16. Lesser Pandas
17. Prairie dogs
18. Bears and monkeys (a-m)
19. Reptile House
20. Tortoise yard
21. Monkey House
22. Hardy Animals (a-o)
23. Lion House
24. Komodo Dragon
25. Bears (a-j)
26. Water animals (a-e)



- 27. Sea Lion pool
- 28. Wolves, foxes, and wild dogs (a-l)
- 29. Monkey cages (a-b)
- 30. Waterfowl ponds (a-d)
- 31. Police Station—Restrooms—First Aid
- 32. Restaurant
- 33. Picnic Area
- 34. Window Shop
- 35. Souvenir Kiosk
- 36. Rock Creek Parkway entrance
- 37. Friends of the National Zoo Offices
- 38. FONZ Education, Editorial, and Tour Guide Offices



# Reptiles and Amphibians

## Firebellied Toads

New on exhibit in cage F-20 at the Reptile House (*number 19 on map*) are ten firebellied toads (*Bombina bombina*). This is a species of northern and central Europe, renowned for the reflexive warning posture it assumes. When in immediate danger on land, the firebellied toad bends its head and rear end upward so that its body forms an arc, and it tucks its hind limbs up over its body and its forelimbs over its head in back of its eyes. This posture serves to display the bright red mottling on the toad's underside from which it derives its common name. The red coloration appears gradually and is not yet complete until the toad reaches maturity in its third year.

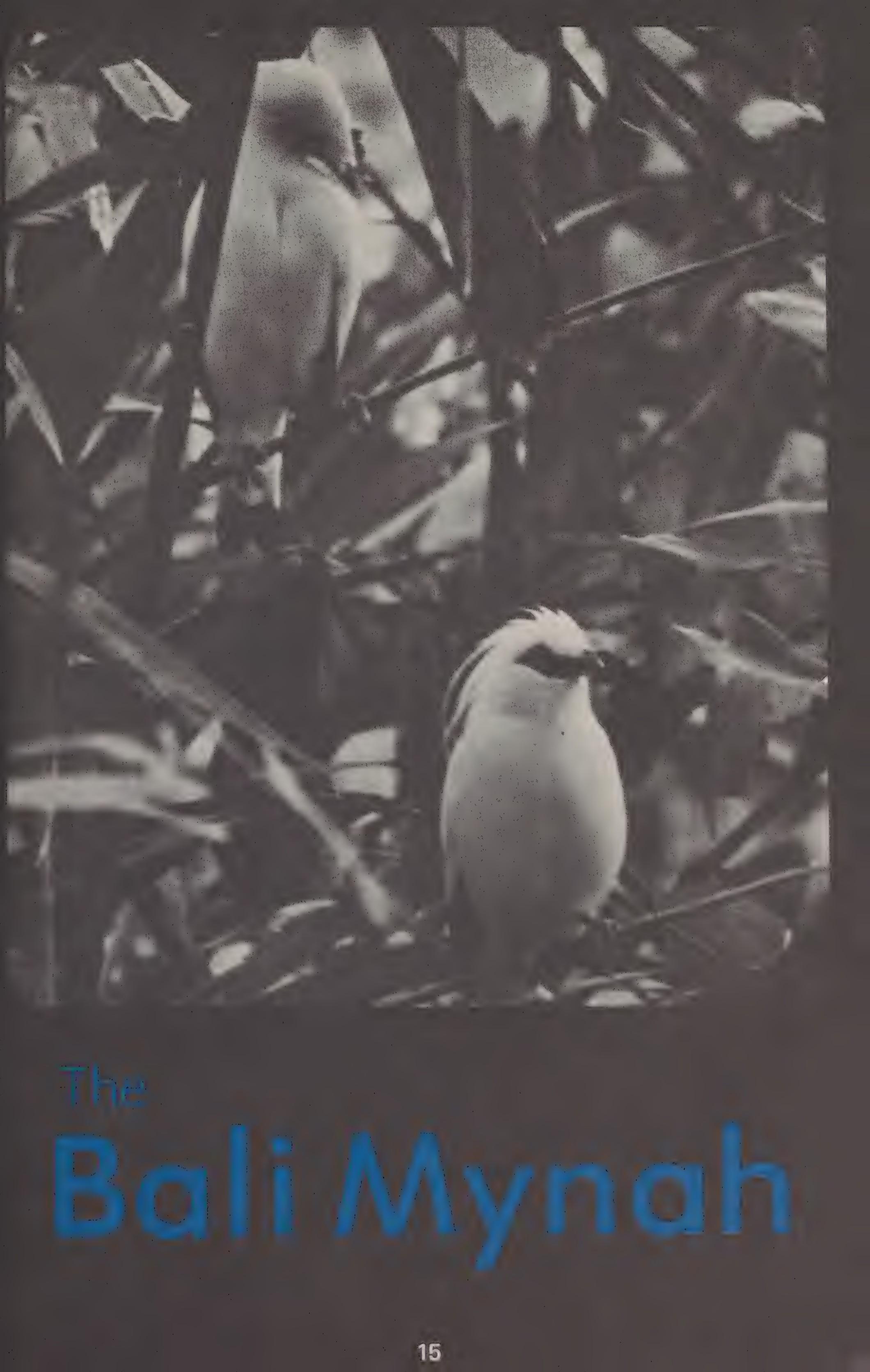
The bright coloration seems to serve as a warning to predators, since the alarm posture is inevitably accompanied by a poisonous secretion from the skin. In man vapor from this secretion causes sneezing

and running of the eyes; but to a small predator that attempted to eat one of these amphibians it might well prove fatal. It is a matter of speculation whether the avoidance response that the firebelly's display evidently arouses in predators is innate or learned. It is usually learned in man; but in other species it is possible that there has been positive selective pressure in favor of individuals that tended to be startled by the sudden display of bright color and thus to avoid the toad, without ever having learned by experience its venomous properties.

When its underside is concealed the firebellied toad is well camouflaged. In the water its ordinary response to danger is to dive to the bottom and perhaps to bury itself in the mud. In either case its dark gray and black back blends completely with a pond bottom. Actually the firebelly is one of the most fully aquatic of the frogs and toads. For instance it and the other members of its genus possess lateral-line organs as adults. Present in fishes, in the tadpoles of all frogs and salamanders, and in the adults of aquatic salamanders and a few aquatic frogs, these organs on the head and on the sides of the body are sensitive to low-frequency vibrations caused by movement in the water around the animal.

Firebellied toad.





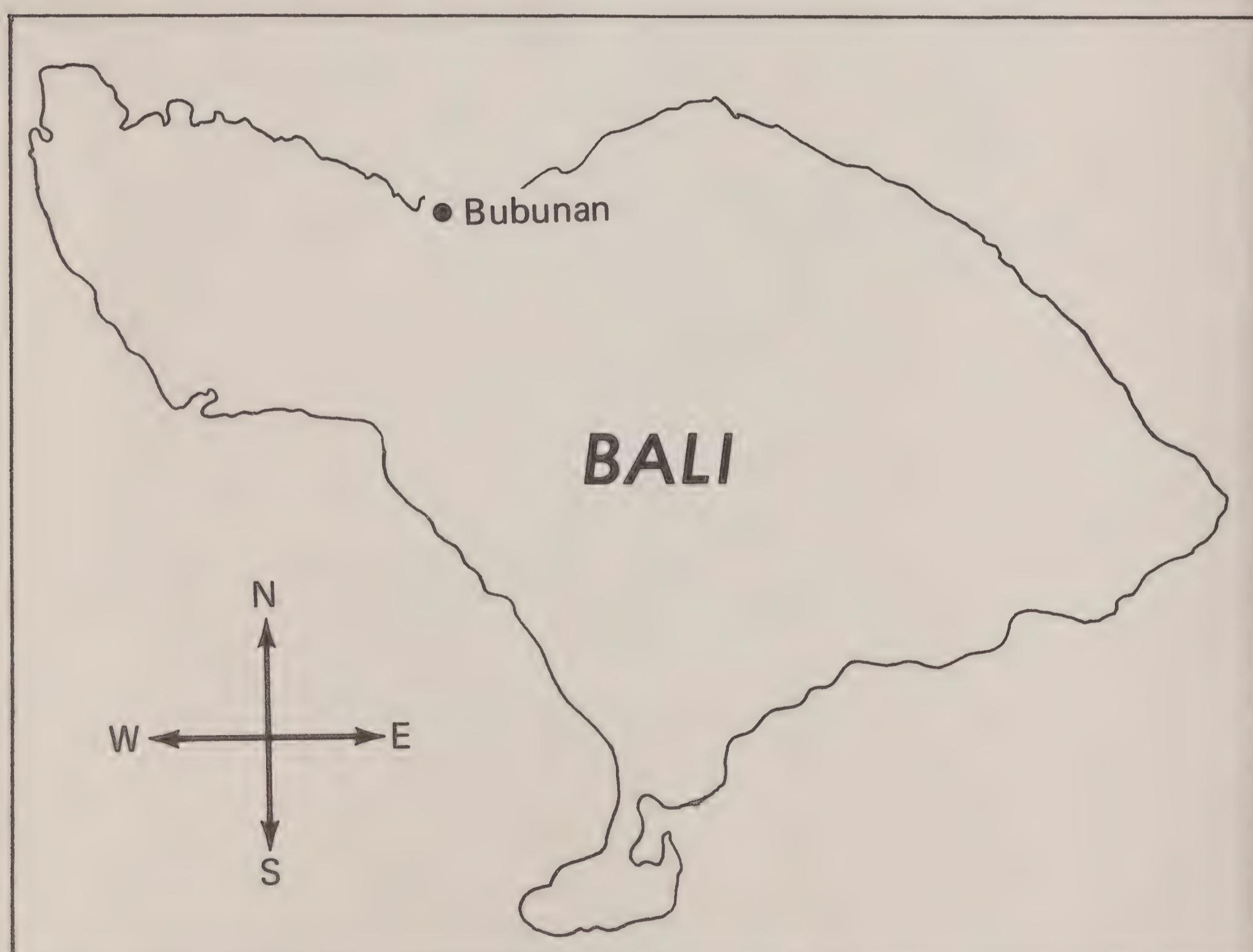
# The Ballynah

On the Indonesian island of Bali there lives a beautiful and little known bird, found nowhere else in the world. White over its entire body, except for black tips on its wing and tail feathers and a streak of bare blue skin around the eye, and adorned with a crest of longer plumes on the head, it is also a rare and endangered bird, so listed in 1966 by the Red Data Book of the International Union for the Conservation of Nature and Natural Resources (I.U.C.N.). This species is known by a variety of names. To scientists it is *Leucopsar rothschildi*, sole member of its genus and one of the 104 species of the starling or mynah family, the Sturnidae. Reflecting the virtual interchangeability of the terms starling and mynah in English references to members of this family are the common names used for this prized bird by aviculturists: Rothschild's starling, Rothschild's mynah, or the Bali mynah.

Bali, about 2100 square miles in area, is situated directly to the east of the much larger island of Java, at the beginning

of the long chain of islands known as the Lesser Sunda Group. Like Java it is heavily populated; and, as evidenced by its ancient civilization, there is no doubt that it has long been so. As in so many parts of Asia, however, the population is currently continuing to grow at an accelerated rate. In the southern half of the island, where the great majority of the approximately two million human inhabitants live, it is estimated that there are more than 1,500 persons per square mile. Mild in climate year round, blessed with abundant rainfall and fast-flowing streams and rivers readily adaptable to the purposes of irrigation, this is the region where climate and topography have most favored the development of agriculture in Bali's historic past; and it is the region where now thousands of tourists come each year to see the old Hindu temples and the famous dances of the islanders.

The rest of the island, which is far less densely populated, can be divided into three separate ecological zones. Moving



Map of Bali, showing the town of Bubunan, in the vicinity of which the Bali mynah was first discovered and where its only known habitat exists today.

northward the southern lowlands gradually give way, through elaborately terraced and irrigated foothills, to dense mountain forests and the volcanic peaks that betray the island's origin. The highest of these, the 10,308-foot Mount Agung, is still active, having last erupted in 1963. These mountainous central regions appear to have remained largely in a pristine state; and due to the scarcity of teak the forests have not been logged heavily. To the north of the mountains, there is a narrow coastal strip of arable land that is the second most heavily populated part of the island, although, due to its exposure to hot dry winds from the north, it has apparently never seemed as attractive to human settlers as the mountain-protected southern lowlands. Finally, the peninsula that extends westward towards Java constitutes a further distinct zone that remains almost uninhabited.

Most of this last-mentioned region consists of harsh, arid uplands, rising to a height of 4,000 feet above sea level and covered with scrub and low forest. Here it was that the Balinese race of the tiger (*Panthera tigris balica*) evidently made its last stand before being hunted to extinction. And it is on this peninsula that the only known habitat of the Bali mynah is located.

The Bali mynah was unknown to science until 1912, when it was first collected and described in the vicinity of Bubunan, a town situated on the north coast on the shores of a small inlet of the Bali Sea. Bubunan is apparently the westernmost town of any size on the north coast, marking the approximate western limits of the settled region and the beginning of the wild western peninsula. The few who have attempted to study the distribution of the Bali mynah since 1912 have asserted that it seems to exist only in a very restricted region around Bubunan, where it is said to have been abundant until quite recently. Exactly how far it ranges to the west, east, and south does not seem to have been ascertained. South of Bubunan, the uplands of the western peninsula rise rather abruptly. It is evident that the Bali mynah inhabits part of these uplands, but it is unclear how far it ranges in similar terrain to the west and to the south. Again it seems unanswered how well—and how far east—the mynah is able to coexist with man on the northern coast—or whether it is



able to do so at all. The fact that these questions cannot be decided on the basis of the scant available literature indicates the urgent need for an ecological and distributional study of the Bali mynah if conservation efforts are to be successful.

When we are confronted with any animal species that is confined to a small area, the question that immediately occurs is whether it has always been restricted to this area and has evolved in response to highly specialized environmental conditions present there or whether, due to man's interference or some other cause, its range has been reduced to the extent that the species remains a relict only in a circumscribed portion of it. In the case of the Bali mynah we simply do not know the answer, and until we know more of its ecology and its habitat requirements we are not even able to guess. The late date of the species' scientific discovery and the circumstances surrounding it suggest that in 1912 the Bali mynah was probably restricted to an area not much larger than that which it occupies today; but the long period in which there has been advanced human culture on Bali has doubtless seen a great many alterations of the environment, and perhaps in the distant past the Bali mynah was found in

portions of the island from which it has long since disappeared.

At the present time, however, it is almost certainly not human alteration of the environment that is reducing the Bali mynah's numbers. Rather it seems that before its discovery by Europeans the mynah—whatever its earlier history—had achieved a stable if limited foot-hold on a crowded island, and that even today this foot-hold is not being subjected to ecological ruin. The tragic fact appears to be that in this case, rather than destroying an animal's habitat as he so often has in the past, man has been systematically removing the animals while allowing the habitat to remain essentially intact. Soon after its discovery the Bali mynah began turning up in European countries as a cage bird. Its beauty and its rarity commanded high prices, and it was not long before unscrupulous dealers were trapping and exporting Bali mynahs in greater numbers than a restricted population could indefinitely withstand. And the trade continues; although the I.U.C.N. was informed that part of its range is contained within one of two national parks on the western peninsula, the Bali mynah is not yet on the Indonesian list of protected birds. The national parks, moreover, do not appear to be well policed; their existence was not sufficient to save the Bali tiger from Javanese hunters.

These facts have put the zoos and private collectors that have Bali mynahs under a moral obligation to breed them in order to meet the demand for captive animals from their own stock and thus halt the raiding of the wild population. In mid-1965 there were exactly 100 of the species in 26 zoos, and an undetermined number—estimated to be far greater—in private hands. Fortunately zoos have been increasingly willing to face their obligations towards endangered wildlife, and serious efforts to breed the Bali mynah have begun in the United States and Europe. The National Zoological Park has taken a leading role in these efforts, and 39 of this species have been hatched here since 1970, many of which have been sent to other zoos.

The history of the Zoo's success with Bali mynahs begins with six wild-caught birds acquired from a pet dealer in April, 1970, and placed in the indoor flight room at

the Bird House (*number 5 on map*). In December of the same year the appearance of two fledglings took Bird House personnel by surprise; no one had suspected that a pair were nesting. The same pair nested repeatedly, beginning a new nest in one or other of the nest holes set in the faces of the large artificial cliffs set on the north wall of the room almost as soon as the previous clutch was fledged.

If captive breeding of any endangered species is to prevent further inroads on the wild population and assure a continued supply of its own, it is necessary to produce offspring both of whose parents were themselves born in captivity. Though in recent years a number of zoos have had successes similar to that of the National Zoo in producing offspring from wild-caught parents, second-generation captive breeding has in most cases proved a stumbling-block. Efforts to produce offspring from National-Zoo-hatched Bali mynahs proved fruitless until this past October 9th when a Zoo-born pair in cage #2 at the Bird House—the large cage to the right of the front door of the building—hatched two eggs in a wooden nest box. Second-generation captive breeding of Bali mynahs has, it appears, been successful in only one other Zoo, that in Zürich, Switzerland.

In addition it was a good deal easier to make detailed observations of the entire sequence of courtship, nest-building, incubation of the eggs, and rearing of the young on the part of the pair in cage #2 than it had ever been in the case of the pair in the indoor flight room; as a consequence, some new insight was gained into the little understood behavior of the Bali mynah. The birds in the indoor flight room had not been supplied with colored leg-bands, which would have made it possible to distinguish individual birds. Sometimes, as it happened, an observer could be confident that he was watching a member of the breeding pair—for instance, when a bird was seen taking food to a nest hole in which there were known to be young. Occasionally, too, two birds could be seen in the vicinity of the cliffs behaving in ways that Bird House personnel had come to believe characteristic of mated pairs of this species. But often the breeding pair would mingle freely with other Bali mynahs in the room, especially around the feed trays, and it would no longer be

possible to single them out.

The second-generation pair, on the other hand, were the only Bali mynahs in their cage. Moreover, it was possible to distinguish the male from the female on sight—which is not always the case in this species, where the only observable external

difference between the sexes as yet known is that the male's crest is somewhat longer. (The female has a black band on her left leg.) An almost daily watch was maintained on the pair in cage #2 for periods ranging from several minutes to about five hours on any given day, from September 4th, soon after they began to show signs of



pair-formation, until November 1st when the young left the nest. This 57-day span can be conveniently divided into three periods: the courtship and nest-building period from September 4th to September 26th, the incubation period from September 27th to October 9th, and the nestling period from the latter date until November 1st. Each of these periods was marked by distinctive activities and behavior patterns on the part of the Bali mynah pair, while other aspects of their behavior seemed to remain more or less constant for the entire time of observation.

From the start of the courtship period, several behavior patterns could immediately be noticed that had previously been observed on the part of the pair in the indoor flight room. One was the bobbing display, in which the bird erects its crest, throws its head back, and bobs up and

One of the Zoo's two recently hatched Bali mynahs at the nest box entrance the day before it and its sibling left the nest.



down repeatedly on a branch. This display is usually accompanied by a series of clucking sounds that often terminate in a low growl; both sexes performed it often and with about equal frequency during the courtship period. Sometimes during that period the two birds performed it simultaneously, perched about a foot apart; in these cases it apparently had a function of mutual stimulation to breeding. Frequently, too, even though only one bird bobbed, the other was nearby, having just completed a bobbing display of its own or having just flown over.

At other times one bird would perform the display while the other was in the nest box in cage #2, either taking materials in to build the nest or apparently simply investigating the nest site. In these cases a function of mutual stimulation might still have existed, since the bird in the nest box would presumably have known, because of the accompanying clucks and growl, that the other bird was performing the bobbing display; but it cannot be ruled out that in the wild the bobbing display also serves to advertise the existence of a courting pair to neighboring Bali mynahs. Certainly bobbing tends to make a Bali mynah conspicuous. Although a white bird is hard to overlook in the open, in thick cover—as visitors to the indoor flight room can verify for themselves—light and shadow play tricks that make a Bali mynah difficult to spot. Under such conditions the bobbing display could easily serve to attract attention.

On a few occasions the bobbing display on the part of one bird stimulated the other bird to preen it. Mutual preening had been observed between the members of the indoor flight room pair and had long been suspected to be a sign of pair formation. During the courtship period, each bird preened the other about an equal number of times; during the incubation period, however, the female was observed preening the male more often than he was observed preening her. The male seemed to preen the female's throat most frequently, at which times she would hold her head high and erect her crest; the female was equally likely to preen the male's throat, the side of his neck, or the back of his head.

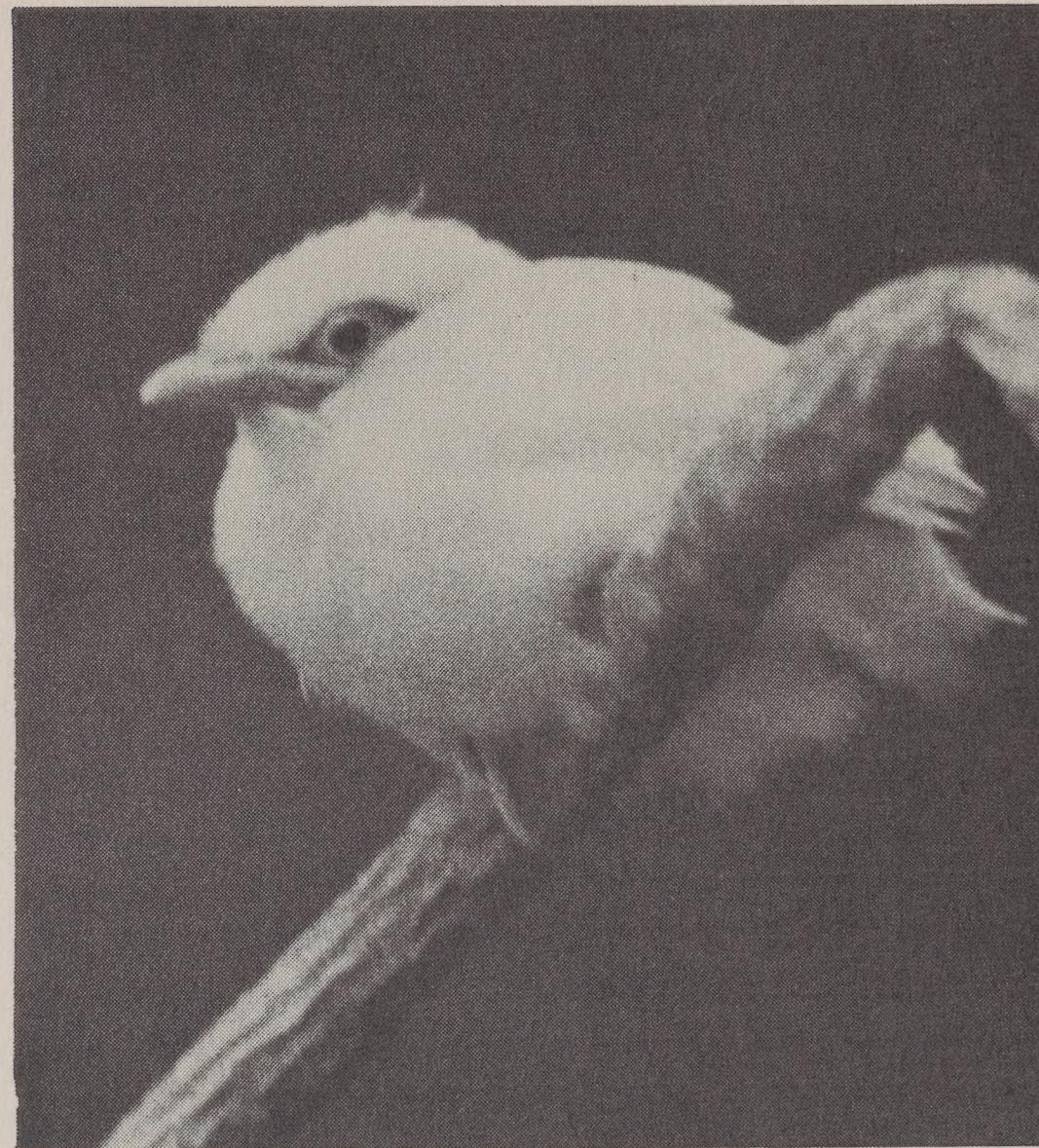
Once an interesting behavior pattern was observed that may provide a clue to how Bali mynahs tell the sex of other Bali

mynahs—a task that, without some specific innate behavior that clearly signals the bird's sex, would doubtless be as difficult and uncertain for the birds as it often is for us. The male perched next to the female, his head bowed forward and tilted towards her and his crest erected; since the length of the crest is the only marked exterior difference between the sexes of which we are aware at present, any display involving crest-presentation seems a plausible candidate for a means of indicating the bird's sex to others of his species. The female looked at the male's crest but did not attempt to preen it. He flew away, she performed the bobbing display, and he immediately returned to present the crest in an identical fashion and with an identical response on the female's part.

Beginning on September 4th both birds were frequently seen gathering straw, leaves, and other nest materials and taking them into the nest box. Once the male took up a piece of material, then began calling and dropped it, and twice he gathered material but failed to take it to the nest. Meanwhile the most obvious and constant sign of pair-formation was an extraordinary outburst of vocalization on the part of both birds. Like their relative the common starling (*Sturnus vulgaris*), Bali mynahs are very vocal birds, with a varied repertoire of calls and chatters—most of which, however, again like those of the common starling, seem rather unmusical to human ears.

On the basis of structure and apparent function the vocalizations used by the pair in cage #2 could be divided into three categories: brief contact and location calls, stereotyped longer calls, and finally highly variable, "creative" calls—which, however, were usually made up of about half a dozen invariable elements, combined in an extremely wide variety of ways.

Calls of the first category can be heard in all Bali mynahs. One is a rather soft, one-syllable whimper-like sound used almost every time a bird of this species takes flight; it can be repeated twice in rapid succession or accompanied by a harsher squawk if the bird takes flight in alarm. Evidently in its most common form it functions simply to inform others of the species of the fact that the bird has taken to the air; but it can also function to indicate a bird's location or change of location in a number of other contexts. For instance it may also be used on



Fledgling Bali mynah, five days after leaving the nest.

landing near another bird to alert it to the new arrival or to indicate changes of position while a bird is foraging on the ground; and once, early in the courtship period, the female in cage #2 entered the nest box and repeated this call several times while inside. A second call, a loud, high "wheet", seemed to be used by each member of the cage #2 pair to maintain contact with the other. This call was frequently exchanged by the members of the pair in the early days of courtship or uttered repeatedly in unison, as were apparent elaborations of it that might be rendered "umwheat" and "umwheety-wheat."

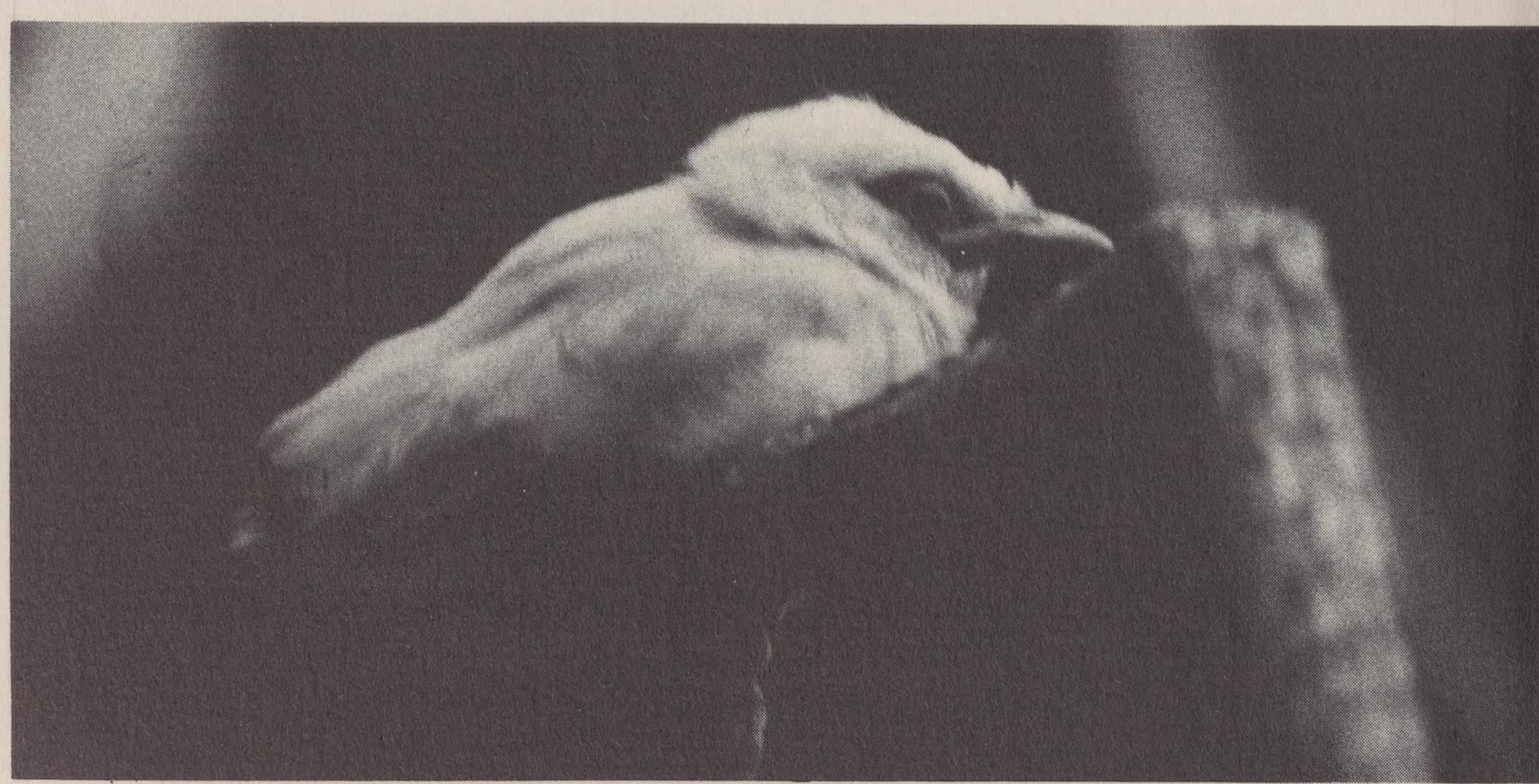
The latter call, as time went by, became more and more exclusively the property of the male, and it occurred in situations in which calls of the second category usually occurred. Thus it might be considered one of them. The second category calls, though a number of syllables in length, were characterized by a relatively slight degree of variability, by their easy recognizability to human ears, by a relatively high degree of musicality in tone, and by the fact that each individual call of this type tended to be monopolized by one member of the pair. Moreover, their apparent function and the circumstances in which they were given underwent a change during the period of observation.

From the beginning of the courtship period, the female frequently uttered an immediately memorable call that might be rendered as "*umwheel-whirry wheet-whirry wheet*." There were occasional slight variations. The male would often at first call at the same time. Sometimes he would give a soft "*hant-hant-hant*" call towards the end of the female's call, but he might also accompany her by giving the "*umwheel*" contact call or even the clucking sound that ordinarily forms a part of the bobbing display. Like the duets and vocal exchanges of courting birds of a number of species, these duets no doubt played a part in the establishment and strengthening of the pair bond. On September 4th the male was four times heard giving the stereotyped call that formed the female's part of these duets, as compared to ten times that the call was given by the female; the female did not duet with him when he did so. After that day he was not once heard giving the same call again, although the female continued to use it throughout the courtship, incubation, and nestling periods, a recorded total of 81 times.

Gradually duetting ceased, and the female began to use her call most often when the male was in the nest box. Indeed throughout the periods of incubation and of the rearing of the young, when the birds took turns on the nest, incubating the eggs and brooding or feeding the nestlings, the female typically used this call when the male was in the nest box. The male, too, had stereotyped calls that the female rarely used, and he most frequently gave them when she was on the

nest. One of these was the "*umwheety-wheet*" call mentioned above. Another was a high, quite pure-toned "*whityew*" usually repeated three or four times. Then there was a series of four or five calls at one pitch followed by another series of calls pitched approximately a minor sixth above the first series on our musical scale.

It was under similar circumstances, with one of the pair in the nest box, that the third category of call found its greatest occurrence. These calls were made up of a number of distinct one-, two-, three-, or four-syllable elements, which could be combined in various ways at various times. At first the male produced these calls almost exclusively and usually when both birds were out of the nest box, evidently as part of his courtship; sometimes he would combine recognizable elements with a number of tonally impure and to human ears almost indefinable chatters and whistles to produce a long—though most unmusical—song, bewildering in its complexity and its apparent originality. He produced these songs far more frequently than the female did. Later he appeared largely to abandon them; and he and the female both, usually while the other bird was on its nest, began to combine five recognizable elements in shorter, but still multi-syllable calls. An individual call might be repeated a number of times in an individual calling session but was rarely repeated in exactly the same form during subsequent calling sessions on subsequent days. Interestingly there was a sixth call-element that the male used frequently, and the female almost



never, in composing calls. This element, in addition to appearing in longer, variable calls, appeared to be essentially the same as the "umwheety-wheet" or "wheety-wheet" that by itself had come to be almost monopolized by the male.

On the afternoon of September 19th the male was observed chasing the female repeatedly around the cage and repeatedly attempting to mount her. Both birds were silent while the chase was going on. The male did not appear to have copulated successfully; but he remained in a high state of excitation even after giving up his pursuit, hopping frequently from perch to perch, pausing to preen himself intensely, and on one occasion attacking a glossy starling without provocation. Such behavior provided outlets for his excitement and could be classified as displacement behavior—the venting of a frustrated drive-state on inappropriate activities. Later in the day he gathered a bill-full of nest materials, including several twigs about six inches long; he tried five times to take these into the nest box but could not get through the small opening with such a large load. Only after his efforts had resulted in knocking the longer twigs from his bill was he able to get in.

By the morning of September 27th, the birds were regularly taking turns in the nest box and were only rarely both outside for any length of time, usually in mid-afternoon. It was evident that they were incubating eggs. The changing of the guard at the nest generally followed a stereotyped pattern. The relieving bird would fly to the top of the nest box and lean over the edge to look down into the hole; often it would give the above-mentioned whimper-like location call one or more times while on top of the nest box to inform its mate of its arrival. Then it would fly to a branch directly in front of the nest box entrance, also often giving the location call one or more times and perhaps pacing the length of the branch towards the nest box, away from it, and then back towards it, before finally entering. Soon afterwards the other bird would emerge. The birds continued to add materials to the nest throughout the incubation period. The nest in this case was not observed. But the nest boxes set in the cliffs of the indoor flight room have plexiglass tops through which nests can be examined from scaffolding inside the hollow artificial

cliffs; and nests there were observed to be cup-shaped, their edges lined with large flight feathers of other species.

On the afternoon of October 9th both birds were off the nest and appeared quite excited. They were flying at the walls of the cage in an evident attempt to get out. The first explanation that occurred was that the eggs had hatched and that they were attempting to get out because they needed food for the young; moreover, in the case of the one indoor flight room clutch for which the incubation had been determined, two eggs had hatched after twelve days and a third after fourteen, and it was now twelve days after the birds in cage #2 had begun incubating. Inspection of the nest box showed that there were indeed two hatchlings and a third unhatched egg. A pan of mealworms was provided, and the parents immediately began to collect them, breaking them up with their bills, and take them into the nest box. On one occasion that afternoon the female took at least a dozen mealworms into the nest at once, and an entire pan was consumed—with some help from other birds in the cage—in less than two hours. On subsequent days the feeding and brooding of the young followed an orderly routine, with changes in turn reminiscent of those that had occurred during the incubation period.

The third egg failed to hatch, was either broken or removed by the parents. But the two nestlings thrived and by October 24th they were both frequently putting their heads out of the hole of the nest box and cheeping loudly, begging for food, when they were hungry. By October 29th they were regularly appearing in the nest box opening in a pre-flight posture; and on the morning of November 1st both flew from the nest.

The Bird Unit is proud of its fledgling Bali mynahs and hopeful that the same pair and perhaps other second-generation pairs will raise further clutches. Study of them and eventually of color-marked birds in the indoor flight room should yield more information about the behavior of this species—a topic that still holds many intriguing mysteries. The first obstacle to full-scale captive breeding of an endangered species has been overcome; and what has been learned here and the much that hopefully will be learned in the future may in time prove helpful to others engaged in the effort to preserve the Bali mynah.

